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Contracting, Imperfect Information and the Food System

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Introduction

Conventionally, in competitive economic theory, it is assumed that price taking firms and consumers have perfect information concerning market prices and other factors such as product and factor quality, and effort exerted by agents. In addition, it is common to appeal to the notion that firms and consumers passively respond to prices listed by the Walrasian auctioneer. The corollary of this is that a competitive equilibrium will ensure the efficient allocation of resources in factor and goods markets. As Stiglitz (1989) points out, not only has the Walrasian auctioneer "long been thought of as a convenient fiction" (p.771), but this "traditional view is fundamentally incomplete, incorrect and misleading" (p.771).

While such problems as imperfect competition, externalities and public goods are well-known violations of the first-best optimum, it is only recently that important advances have been made in economic theory in analyzing the effects of imperfect information in markets (Stiglitz, 1985). In particular, much of the literature can be characterized as having focused on the impact of two types of information problem that face economic agents. First, there are models that deal with the problem of *adverse selection*, which is where one party to a transaction is better informed than another about the characteristics of what is being bought and sold. Second, there are models that analyze the case of *moral hazard*, which is where one party has imperfect information concerning the action that another party takes. Essentially, once these types of information problems are taken into account, it may be the case that an efficient allocation of resources is not attainable through private actions, and, therefore, there may be a case for some form of government intervention (Stiglitz, 1985).

In this context, the overall objective of this paper is to consider how the problem of imperfect information, as defined above, might impact resource allocation in a food system

increasingly characterized by some form of contracting, and to consider what the implications are, if any, for the traditional role of government as a supplier of market information to the food and agricultural sector. The conceptual framework that will be used to illustrate this problem is that of *principal-agent.* In particular, the main focus will be on the case of markets in which the relevant parties are in the agricultural and first stage processing/handling sectors. However, it should be recognized that the application is more general, and reference will be made to other contractual relationships in the food system.

The paper is organized as follows: Section 1 lays out the basic principal-agent problem, paying particular reference to contractual relationships between the agricultural and processing sectors. Section 2 develops the concept of principal-agent with respect to the trade-off between risk-sharing and effort incentives. Although, of necessity, this will be a very stylized view of such linkages in the food system, it will highlight the basic problem of imperfect information in contracting settings and how this impacts the allocation of resources. Section 3 will then consider whether the existing public supply of information is relevant to the resolution of these information problems. Section 4 will briefly consider other contractual relationships in the food system, while Section 5 summarizes.

1. Principal-Agent and Contracting in the Food System

One of the most striking features of structural change in the food system over the past three decades has been the shift in several agricultural commodity markets away from spot transactions to some form of production/marketing contract between farmers and first-stage processors/handlers (Barkema, Drabenstott and Welch, 1991; Barkema, 1994; O'Brien, 1994;

Drabenstott, 1994). These can range from market-specification contracts through production-management contracts to resource-providing contracts. The best-known, and best-documented of these structural changes has been the case of the broiler industry, where the share of broilers produced under contract is about 90 percent, and traditional spot markets no longer exist (Knoeber, 1989). Other markets where contracting is important include, turkeys, eggs, fruits, vegetables, and sugar beet. More recently, the pork industry has exhibited a trend towards contracting between hog farmers and pork processors (Barkema; Barkema and Cook, 1993; Drabenstott, 1994; Hurt, 1994), about 18 percent of production in 1990 being accounted for by contracts, compared to 1.5 percent in 1980 (O'Brien). Drabenstott argues that this process of "industrialization" appears to be accelerating, and he predicts that contracting will continue to characterize structural change in the pork industry, with cattle feeding following a similar path in the future.

In the case of broilers, coordination of production is undertaken by firms known as integrators, for example, Tyson, Perdue and Holly Farms. The key characteristic of this system is that the integrator contracts with growers to raise chickens to maturity. Baby chicks, feed, medical services and managerial advice are provided to the grower by the integrator, while capital, in the form of chicken houses, and labor are provided by the grower (Knoeber). Similar types of arrangement also characterize the use of contracts in the pork industry, where the hog farmer supplies capital and labor, while the contractor provides young pigs, feed, medical services and managerial advice (Barkema; Barkema and Cook; Hurt).

The economic rationale for this type of market arrangement has been thoroughly covered elsewhere in the literature (Sporleder, 1992), the standard explanations referring to firms either

responding to risk in dimensions such as price and quality, changes in production technology and the potential for realizing economies of scale, or transactions costs. In addition, these structural changes have to be set in the context of an environment of changing consumer tastes and the need to target niche markets (Barkema *et al.*; Drabenstott). However, the key to understanding the nature and impact of imperfect information in a marketing system increasingly characterized by contracting is that such economic arrangements have the characteristics of a principal-agent problem, where the farmer/grower is the agent, and the contractor is the principal. It should be noted that this is by no means an original observation, Barry, Sonka, and Lajili (1992) having already referred to the notion of agency relationships in the food system.

Following Stiglitz (1987), the standard principal-agent problem is one where a principal (the first-stage processor/handler) is seeking a contract with an agent (the farmer) that will maximize the principal's expected utility. This is contingent on the agent (the farmer) undertaking some set of actions to maximize their own expected utility given the compensation scheme, and that the agent is willing to undertake the contract, i.e. the contract makes the agent no worse off than their next best opportunity $\bar{U}$ (the rationality constraint)[1]. Formally, suppose the compensation scheme Y depends only on the output of some agricultural commodity X that is observable to both principal and agent:

$$Y = \phi(X) \tag{1}$$

where the parameter ϕ defines the relationship between the payment scheme Y and the level of output X.

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[1] We are assuming here that both the principal and agent's preferences are in accord with the von-Neumann-Morgenstern axioms of expected utility (see Hey, 1979).

Suppose then that the output of X is a function of both effort by the agent e[2], and some chance productivity factor θ[3]:

$$X = f(e,\theta) \tag{2}$$

The agent will exert effort to maximize expected utility EU which is a function of both income (positive utility) and effort, which is assumed unpleasant (negative utility):

$$\max\ EU(Y,e,\theta) \tag{3}$$

The expected utility of the principal EV depends on the effort of the agent, the payments made to the agent, and the state of the world θ:

$$EV = EV[\phi(X),e,\theta] \tag{4}$$

The principal's objective is to choose ϕ, and, hence, the payment scheme, in order to maximize EV, recognizing that the agent's effort e depends on ϕ, and that the payment scheme must satisfy the agent's rationality constraint $\bar{U}$.

As will be discussed in the next section, it turns out that the optimal contract offered by the principal will depend upon both the principal's and agent's attitude towards risk and the extent of moral hazard. In particular, contracts will reflect a trade-off between the extent to which the principal will be willing to provide insurance to the agent as opposed to the need to give them incentives to exert effort, given that the agent's effort may not be perfectly and costlessly observable by the principal.

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[2] Effort is treated as a catch-all here in order to cover aspects such as achieving the right product quality.

[3] For example, high temperature, and disease such as Marek's disease, reduces broiler output.

2. Risk-Sharing and Effort Incentives

(i) Efficient Risk-Sharing

In the simplest setting[4], suppose the agent's effort e cannot be observed by the principal, but that θ is verifiable by both parties. In these circumstances the principal can provide incentives to the agent because both principal and agent can establish the outcome X of a given amount of effort $\bar{e}$ in various states of the world θ. Therefore, the compensation scheme can be made a function of both the outcome X and the state of the world θ. The principal could offer a payment scheme Y of the following form:

$$Y = [P(X) - k(\theta)] \tag{5}$$

where P(X) is the price the principal can sell the output at, and $k(\theta)$ is a state dependent "franchise fee" that the principal extracts[5]. Essentially, the agent is motivated to exert effort because they are made the residual claimant, i.e. the results of extra effort always accrue to the agent. The nature of $k(\theta)$ will determine the extent to which risk will be shared between the principal and the agent.

Suppose that $k(\theta)$ is a constant k whatever the state of the world. The willingness of the agent to accept this contract will depend on their attitude towards risk. If the agent were risk

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[4] This draws heavily on Ricketts (1987), and Sappington (1991).

[5] In practice, in a contracting relationship between farmers and first-stage processors, the agent's output would undergo some form of processing, therefore, P(X) would be related in some way to the price that the principal receives for the processed output. In addition, to keep the problem simple, P(X) is not treated as random, although, as Antonovitz points out in her discussion of this paper, the principal might face a good deal of price uncertainty. In terms of the contracting relationship, the principal has to provide incentives to the agent, irrespective of downstream price uncertainty, however, in terms of the principal's willingness to bear risk, downstream price uncertainty may be important, depending on the principal's attitude to risk. If the principal is risk neutral, downstream price risk does not matter, if, on the other hand, the principal is risk averse, the contract may require the agent to bear some of the price as well as output risk, although the principal may be able to use other instruments such as futures contracts to hedge the price risk.

neutral, they would accept this contract[6]. However, it seems more reasonable to assume that, in the case of contracting in the food system, agents (farmers/growers) are risk averse, while principals such as the broiler integrators and pork producers are risk neutral. In this case, a risk-averse agent would not accept the contract as they would have to bear all the output risk and effectively insure the principal against uncertainty. Ideally, a risk-neutral principal should bear the entire risk[7]. In particular, a fixed payment could be made to the agent whatever the state of the world, as long as the standard effort $\bar{e}$ is exerted. This point is illustrated in **Figure 1.**

Suppose that there are only two output outcomes X_1 and X_2, $X_1>X_2$, which occur with probabilities π_1 and $\pi_2=(1-\pi_1)$, and, for the moment, assume that these outcomes are independent of effort. The dimensions of the box in **Figure 1** represent the value of output P(X), which, under the terms of the contract, is split between the principal and agent. The horizontal and vertical dimensions represent the value of output $P(X_1)$ and $P(X_2)$ respectively, and 0_A and 0_P are the origins of the agent and principal respectively. U_A and U_A', and U_P and U_P' are lines of constant expected utility (indifference curves) for the agent and principal respectively, their shape being dependent on their attitudes to risk, while the 45^0 lines are the certainty outcome lines, along which the slopes of the indifference curves are equal to the slope of the constant expected outcome line[8]. As drawn, the agent is assumed to be risk averse such that a move from point t to point r would result in a lower level of expected utility as the agent is unwilling to accept a "fair" gamble, the move from t to r having an expected value of zero. In contrast, the principal

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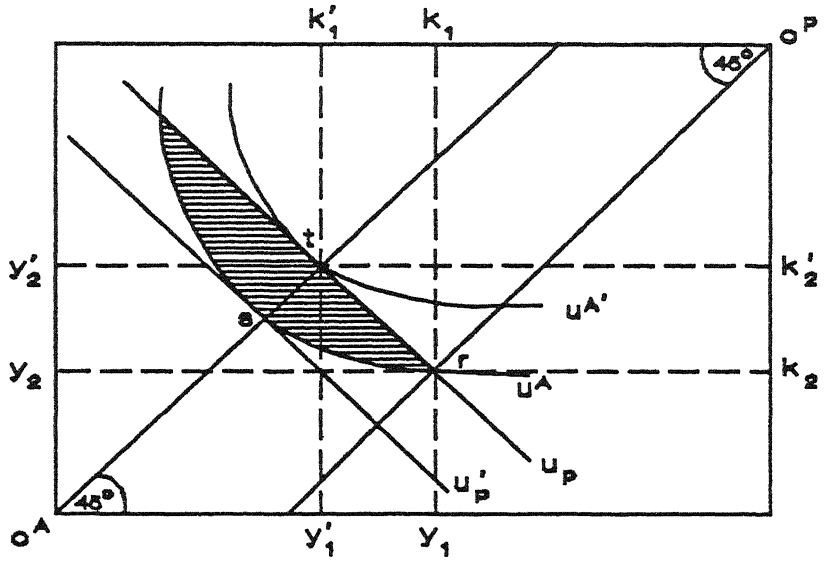
[6] Risk neutrality is where an individual is indifferent between a certain outcome and a random outcome with the same expected value (a "fair" gamble), while risk aversion is where the individual never accepts the random outcome.

[7] If both principal and agent were risk averse, they would both have to bear some risk.

[8] Formally, the expected outcome is given as $E=\pi_1(Y_1^A)+\pi_2(Y_2^A)$

is assumed to be risk neutral, a move from point r to t being acceptable as the principal is indifferent between points r and t.

Figure 1: Efficient Risk-Sharing



The core risk-bearing characteristics of the contract between principal and agent can now be highlighted. Suppose the initial contract offered allows for a fixed payment k to the principal, i.e. at point r. At this point the agent bears all the risk due to the chance factor θ. Therefore, any contract in the shaded set would be a Pareto improvement on r. In particular, contracts between s and t, along the agent's certainty line would be efficient, e.g. a move from r to t makes the agent better off and the principal no worse off, the principal offering 'fair' insurance to the agent. A move from r to s would make the principal better off, even though they bear all of the risk, while the agent maintains their level of expected utility.

The key point to this analysis is that if the principal can reasonably infer the agent's effort from observed output and verification of the state of the world θ, then it is optimal for the principal to offer complete insurance to the agent, and the payment scheme has the characteristics of a pure *time-rate* contract, i.e. at the end of each period, the agent receives a certain payment whatever the outcome of θ[9].

(ii) Prevention of Shirking

Unfortunately, if the principal cannot observe θ, the problem of moral hazard now arises in the principal-agent relationship. In particular, as the compensation scheme Y now depends on observable output X only, then offering the agent a fixed payment each period provides the agent with no incentive to exert effort, i.e. the possibility of shirking arises (Alchian and Demsetz, 1972). Essentially, the imperfect information problem exists because the principal cannot observe the agent's effort and it may be too costly to attempt to monitor that effort. For example, Knoeber reports that in the case of broilers, measuring growers' effort in terms of hours and diligence would be a costly activity, growers' performance instead being measured in terms of pounds of broiler meat produced, given the chicks and feed supplied to the grower by the integrator.

In order for the agent to be provided with some incentive not to shirk, some of the risk will have to be borne by them. In particular, the contract will have to contain some element of *piece-rate* incentives. Suppose, therefore, that the probability of a good or bad outcome due to the chance factor θ is not merely given, but can be influenced by the agent's effort, i.e. the

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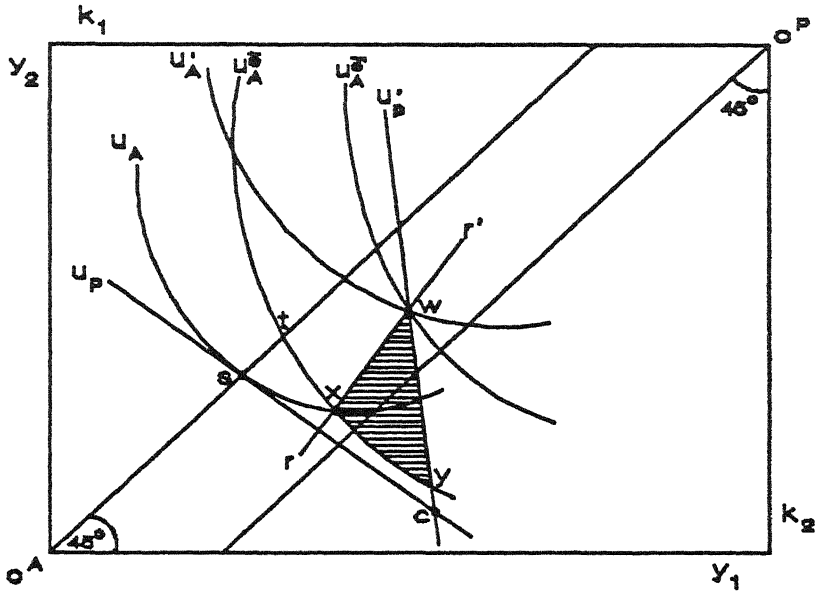
[9] See Stiglitz (1975) for a discussion of contract types.

probability of a good outcome π_1 increases to $\pi_1^{\tilde{e}}$ when $\tilde{e}$ is exerted, which will affect the agent's and principal's indifference maps.

Figure 2: Risk-Sharing and Incentives



In **Figure 2**, point s on the agent's certainty line is the contract offered when θ is observable by the principal, with associated indifference curves of U_A and U_P respectively. With an increase in effort by the agent to $\tilde{e}$, the agent's indifference curve becomes $U_A^{\tilde{e}}$, which is steeper[10]. While this yields the same level of utility as that of less effort, effort is assumed to be unpleasant for the agent. For example, the distance st along the agent's certainty line measures the cost of effort. However, at point x, the agent is indifferent between effort and no effort, and to the right of x, between $U_A^{\tilde{e}}$ and U_A, the agent prefers effort as a higher level of utility can be reached without effort.

[10] Along the certainty line, the slope of the indifference curves increases from $-(\pi_1/1-\pi_1)$ to $-(\pi_1^{\tilde{e}}/1-\pi_1^{\tilde{e}})$.

The effort exerted by the agent also changes the slope of the principal's indifference curve, which now becomes $U_p^{\tilde{e}}$, which intersects the indifference curve U_P at point c on the principal's certainty line, i.e. a certain outcome for the principal is independent of any effort by the agent. The shaded area wxy is the set of potential Pareto improvements on the original contract at s. In particular, efficient contracts will lie along the boundary between x and w, where the agent will just be induced to exert effort $\tilde{e}$.

The key here is that in order to induce effort on the part of the agent, the principal will not offer a contract giving complete insurance against risk when effort and the chance factor θ are not observable by the principal. Essentially, there is a trade-off between efficient risk-sharing and the need to provide incentives. In particular, contracts that will just induce the agent to exert effort will likely contain an element of both a time-rate and a piece-rate[11]. This seems fairly typical of contracts in the pork industry where the farmer is paid a flat fee plus various performance incentives to feed young pigs to market weight (Barkema; Barkema and Cook). In terms of the allocation of resources, the use of piece-rates means that unlike a pure time-rate contract, agents will be paid the marginal product of their increased effort.

(iii) Tournaments vs. Piece-Rates

As Stiglitz (1975) has shown, piece-rates will tend to be used as the method of compensation when the risk is small, the agent's risk aversion is low, and the supply elasticity of effort is high, i.e. there are strong incentive effects. In addition, as noted by Nalebuff and Stiglitz (1983), the problem with piece-rates is that they are a very inflexible incentive structure as it is costly to adapt them. This may not be a problem in the case of a single agent, or even

[11] The pure piece-rate would be given by the diagonal of the box in Figure 2.

a few agents, however, in the case of multiple agents, piece-rates may not be an optimal compensation system. In particular, if there is rapid technological change in production, renegotiation of multiple contracts would be costly. Interestingly, in the case of the broiler industry, integrators have adopted a compensation structure that appears to provide risk and incentive advantages over a piece-rate system. Essentially, integrators in the broiler industry operate *tournaments* among multiple agents.

Tournaments, which have been analyzed in the principal-agent literature by, among others, Lazear and Rosen (1981), Green and Stokey (1983), and Nalebuff and Stiglitz, are compensation schemes where each contestant (grower) is paid on the basis of their performance relative to other contestants. The payment scheme can be based either on an agent's rank in the tournament, or, as is usually the case in broilers, an agent's performance is measured relative to average agent performance. Knoeber discusses this type of payment scheme in detail with respect to broilers. A grower's payment under contract is given as:

$$Y_i = (b + asc - sc_i) \qquad (6)$$

Y_i is the grower's compensation per pound and b is the base payment per pound, i.e. there is an element of time-rate in the contract that provides some insurance to the grower against risk. asc is the average settlement cost, where settlement cost is the sum of chick costs, medical costs, and feed costs per live pound, averaged across a number of growers who harvest at around the same time. sc_i is the settlement cost of the individual grower. Therefore, if a grower's performance is above average, their settlement cost sc_i will be below the average and the grower receives a bonus. Essentially, the measure of settlement cost provides an incentive to the grower to reduce chick mortality, produce heavier birds, and increase feed conversion efficiency.

In theory, how do tournaments work? Following Nalebuff and Stiglitz, it is useful to re-write the output function (2) for the i^{th} agent as follows:

$$X_i = f(e_i, \theta, \varepsilon_i) \tag{7}$$

As before, the agent's output Y_i is observable to the principal, and it is a function of the agent's effort e_i, the chance factor θ, which is assumed common to all agents, and ε_i which an agent's idiosyncratic risk. In the case of broilers, agents are usually located in the same geographic area, and so can be faced with substantial common shocks due to both temperature and disease, and, also chick and feed quality. Therefore, the compensation scheme of comparing average settlement costs to individual grower's settlement costs means that exogenous shocks common to all growers will be differenced out. With enough agents, only idiosyncratic risk ε_i, which relates to individual agent's abilities, need be borne by agents (Nalebuff and Stiglitz). Consequently, it is argued that tournament-type compensation schemes will reduce risks for the agents, but at the same time provide incentive for effort.

There are other important characteristics of tournaments that aid in resolving the problem of moral hazard. In particular, in order to motivate effort among agents, winners, i.e. those that have below average settlement costs, will tend to receive more than their marginal product of effort. All agents believe that by exerting more effort, they will increase their chances of receiving a bonus in the tournament. Therefore, if all agents work harder, the compensation scheme must reflect that. In addition, as Knoeber notes, the types of tournament operated in broilers have some incentive characteristics that make them preferable to rank-order tournaments. In a rank-order tournament, it only pays to win by a little, whereas in a tournament where the size of the bonus depends on the deviation of performance from average, it pays to win by a lot.

Therefore, marginal incentives are preserved, unlike in rank-order tournaments where competition to win can become unstable, such that both the least and best able contestants give up. Incentives are also reinforced by the fact that individual agent's payments are based on a comparison with an average level of performance, about which the principal has no incentive to be untruthful[12].

(iv) Adverse Selection

Up to this point, nothing has been said about the imperfect information problem that the principal faces in terms of selecting agents. Much of the literature has focused either on auctions to resolve this problem (McAfee and McMillan, 1987), or on some form of market signalling (Spence, 1974; Rothschild and Stiglitz, 1976). In the case of contracting in agriculture, it would seem that, at least in the case of the broiler and hog industries, that the provision of capital by the grower is a means of screening agents. This capital is substantial, and it would appear to serve two functions (Knoeber). First, the willingness of agents to purchase capital can be regarded as a signal of agent ability, so that, in a sense, the capital requirement results in the self-selection of high-quality agents. Second, the provision of capital by the agent is a bond assuring future grower performance, i.e. even though growers may receive a certain base payment, there is an incentive to exert effort to generate a return on a long-lived asset.

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[12] For example, overstating the settlement costs of one grower would obviously lower that grower's compensation, but it would also lower the average performance by which other growers are evaluated, which would not be in the interests of the principal.

3. Supply of Public Information and Contracting

The previous section outlined how the increased use of contracting in the food system can be characterized by the existence of informational problems such as moral hazard. However, it was also shown that, even in the absence of perfect information on the part of the principal, and uncertainty for the agent(s), the parties to a contract can adapt in such a way as to address this problem. In particular, contracts can be written between principal and agent(s) that afford the agent(s) some insurance against risk, but at the same time provide incentives for effort, and, hence, provide signals for an efficient allocation of resources. The question then arises as to whether the government can supply additional information that will address the issues of moral hazard and adverse selection in a marketing system that is increasingly characterized by contracting.

The existing public supply of information to the food and agricultural sector can basically be divided into two types, current price information and commodity outlook information. The history and development of the former has been thoroughly reviewed by Henderson, Schrader and Rhodes (1983), while the latter was discussed in a paper by Irwin (1994) presented at these meetings last year. The underlying rationale for the public supply of both these types of information is the notion that information is a public good. Information is a public good in the sense that one economic agent's use of it does not affect the access of other agents to that information. As a result, it is argued that there will be an undersupply of information from the private sector because of the problem of non-appropriability.

Public price reporting has generally been aimed at reporting spot market prices of commodities which still retain their identity, and, in the case of commodities where there is

farmer/processor integration, prices are reported at the first sale of the processed product, e.g. processed broilers and turkeys. Public price reporting had its roots in concerns over the possibility that farmers were being exploited by processors and other traders of agricultural commodities, but has subsequently been justified on the grounds that it aids economic efficiency in the food marketing system (Henderson *et al.*). In particular, it is argued that price reports provide the benefits of a central market without the need for all market participants and products to be in a single location. In addition, by establishing product value, exchange is facilitated.

In the case of commodity outlook information, the basic objective has been to supply forecasts of future prices and quantities, given that decision makers are operating in an environment of uncertainty about these variables. In aiding resource allocation decisions, it is expected that outlook information will result in higher profits, increased utility and, hence, greater social welfare (Freebairn, 1978). As Irwin notes, the public supply of outlook information to agriculture has begun to be questioned in recent years. To some extent the public good argument has been weakened because of the growth in the supply of information from the private sector (Just, 1983). In addition, Irwin argues that the rational expectations revolution has posed an important challenge to the public supply of information. If economic agents utilize available information optimally at the margin and do not make systematic forecast errors, then resource allocation and, hence, social welfare cannot be improved through the supply of public information on, say, future market prices. However, this rather strict interpretation of rational expectations assumes that information is costless and that economic agents learn instantaneously from their forecast errors. Therefore, as Irwin argues, the public supply of information may be a means to

aid a convergence towards a rational expectations equilibrium, and as a result will increase social welfare.

In an environment of increased contracting do these arguments for the public supply of information make sense, and does the information currently supplied address the problem of imperfect information? In the case of public price reporting, the decline in the use of spot markets means that either publicly reported spot prices disappear altogether or that they reflect such thinly traded markets that they are no longer of any real economic benefit. On the face of it this seems to suggest a potential loss of economic welfare. In particular, principal and agent(s) have no basis on which to conduct negotiations over compensation, and related to this there is the possibility that agents will be subject to monopsonistic behavior by the principal. However, the forces pushing markets towards contracting, and the logic of the principal-agent model suggest that a welfare loss will not necessarily occur. For example, in the case of the pork industry, Barkema and Cook, and Drabenstott argue that traditional price signals have become inadequate in terms of transmitting consumer demands through the food system to producers, hence the shift to contracting by the processors, i.e. there was a market failure. Contracts allow the principal to provide the agent(s) with much more precise product specifications, and because of both the agent's rationality constraint, and the need to provide incentives to avoid the moral hazard problem, there is no reason to believe it would be rational for the principal to not provide agents with the correct incentives and act monopsonistically. This argument is particularly valid in the case of broilers where the use of tournaments provides the potential for payments to growers in excess of marginal product, plus there is an incentive for truthful revelation on the part of the integrator in terms of settlement costs.

In the case of publicly provided commodity outlook information, the traditional argument has been that if farmers are risk averse, then information that reduces the degree of uncertainty will aid both their production decisions and increase their welfare (Freebairn). However, as was argued earlier, contracting does provide a degree of insurance to agents against production risk, and, hence, reduces the need for the public supply of outlook information. Nevertheless, while agents do benefit from a reduction in short-term production risk, they may still be exposed to long-run capital risk through the principal's requirement that they supply the necessary production capital. This suggests that there would be economic value to information on the long-run prospects for demand for the principal's product, and, hence the potential rate of return to capital. In addition, although the principal reduces input supply risk through contracting, they are exposed to additional risk through the shifting to them of some of the agent's production risk in contracts, and, as noted earlier, they may also be subject to downstream price risk. This may not matter if the principal is risk neutral, but it does suggest that there may be a premium on information on future consumer needs for the processed product, and detailed information on retail prices. However, it is not obvious how the public supply of price information can help in dealing with the problem of imperfect information.

In summary, traditional supplies of public information to the food system may no longer be relevant where there is increased reliance on contracting. This follows from the fact that contracts provide some insurance against risk to producers, and the principal, in dealing with the problem of moral hazard, has to provide incentives for effort to producers. However, there may be a need for the public supply of information further downstream in the marketing system, which would aid farmers in their capital investment decisions as they consider either entering

contractual arrangements or exiting the industry if they are already small-scale independent producers. In addition, such information may aid in reducing price uncertainty facing processors, however, it is moot whether this should be supplied publicly to large corporations well able to bear risk.

4. Imperfect Information and Other Contractual Relationships in the Food System

It should be obvious that the problem of imperfect information is not peculiar to contracting between the agricultural sector and first-stage processors/handlers. For example, the well-known 'lemons problem' (Akerlof, 1970) refers to the possibility of adverse selection in the sale of, say, high-quality products. Where consumers are unable to verify the stated quality of products prior to purchase, it is argued that all firms will have an incentive to supply low-quality products at a high-quality price. Therefore, without some means of credibly signalling quality, high-quality goods will never be supplied in equilibrium. Nevertheless, the literature has shown that if firms pre-commit to investments in firm-specific assets such as brand names, then consumers treat this as a credible signal of quality (Klein and Leffler, 1981). The repeat-purchase mechanism ensures that any firm who cheats will be punished by consumers. In the case of food marketing, this seems a reasonable argument for branded food products, although it does not necessarily ensure that dimensions such as food safety can be guaranteed by private agents.

Interestingly, this particular problem, along with that of moral hazard, may characterize contractual relationships between food manufacturers and food retailers. The modern theory of vertical market relationships can be thought of as a particular class of the principal-agent problem

(Rey and Tirole, 1986; Katz, 1989). Essentially, a manufacturer (principal) wants to set a contract that induces the retailer (agent) to act in such a way as to maximize the sum of expected profits of the two levels of the marketing system, and which also enables the manufacturer to appropriate all of these profits.

Much of the theory of vertical markets deals with principal-agent problems where there is no exogenous uncertainty about the environment when the contract is signed, so risk aversion on the part of the agent is irrelevant. In such an environment, the focus is on establishing what is a sufficient vertical restraint that will just maximize vertical profits by removing vertical externalities such as successive mark-ups at different stages of the market system (double marginalization). More interesting than the above is the case identified by Rey and Tirole where the principal cannot observe effort on the part of the retailer, and the retailer also faces uncertain demand. In these circumstances, the retailer will require a contract that provides it with some degree of insurance if it is risk averse, but at the same time the manufacturer has to provide the retailer with some incentive to maximize vertical profits.

In the case of the food industry, it seems to be common for food manufacturers to offer non-linear contracts to retailers that are made up of a wholesale price plus a negative franchise fee, commonly known as a slotting allowance (McLaughlin and Rao, 1990; Shaffer, 1991). On the face of it, these negative franchise fees look like the rental price of scarce shelf-space in supermarket outlets, however, they may be more subtle than this. McLaughlin and Fredericks (1994) report that in 1991, 16,000 new products were introduced onto supermarket shelves, compared to about 1000 per annum in the 1970s. At the same time, there seems to be quite a high failure/disappearance rate of these new products, about 50 percent of new products being

discontinued within a year of introduction. This suggests that retailers face an uncertain demand for large numbers of new, differentiated food products.

Theory suggests that, in the absence of demand uncertainty, manufacturers could charge a wholesale price at marginal cost in order to induce optimal effort from the retailer, and then extract the retailer's rents through a positive franchise fee (Mathewson and Winter, 1984). However, with uncertain demand, limited shelf-space, and a large number of new product introductions, it would appear that negative franchise fees, in the form slotting allowances, and other types of allowance such as display and merchandising allowances, are serving two purposes. First, demand for such allowances is aimed at dealing with the adverse selection problem, i.e. the retailer uses slotting allowances as an screening device against really bad 'lemons', and, second, these allowances are also providing the retailer with some insurance against potential product failure and some incentive to exert effort in selling them. Presumably, although this is speculation, the manufacturers are attempting to extract some of the retail rents by setting wholesale prices in excess of marginal cost. The point here is that private markets can adapt to the problem of imperfect information, although one might argue that manufacturers could do a lot better job at initial market research before introducing new products.

5. Summary

This paper has focused on the problem of imperfect information in the food system. In particular, the case of contracting between farmers and first-stage processors/handlers was examined in a principal-agent setting in order to highlight the informational problems of moral hazard and adverse selection that the principal faces. The analysis indicates that, while contracts

can offer agents some degree of insurance from risk, full insurance cannot be offered because of the need to provide incentives at the margin for agents to exert effort. It was also argued that because economic agents adapt to problems of imperfect information, there may not be much of a case for public intervention, at least in terms of dealing with the problem of moral hazard in contractual relationships. However, public supply of information on retail prices and long-term trends in consumption patterns may be relevant for resolving downstream uncertainties that the principal faces.

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